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Multilayer routing using multilayer switch capable LSRs
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Abstract

The integration of multilayer switching capabilities within one box, such as the packet-switch capability (PSC) and the lambda-switch capability (LSC) under the MPLS/Generalized-MPLS control mechanism, paves the way for achieving network resource optimization considering multilayer routing. This document clarifies the model of the GMPLS-controlled integrated PSC/LSC label switch router (LSR) and discusses the requirements of the routing extensions needed to

achieve optimized multilayer traffic engineering.

1. Summary for Sub-IP Area

1.1. Summary

This document adds extensions to the routing protocols with GMPLS extensions in order to support multilayer routing.

1.2. Where does it fit in the picture of the Sub-IP Work

This work fits in the CCAMP.

1.3. Why is it targeted at this WG

This draft is targeted at the CCAMP WG, because this draft specifies the extensions to routing protocols to support multilayer routing of hierarchical label switched paths in the GMPLS network. This type of multilayer routing in the GMPLS network is within the scope of the CCAMP WG.

1.4. Justification

The WG should consider this document as it specifies the extensions to routing protocols in support of multilayer routing of hierarchical label switched paths in the GMPLS network.

2. Introduction

Generalized-MPLS (GMPLS) facilitates the realization of seamless integration of IP Networks with legacy SDH/SONET or Photonic networks. In particular, integration of the packet switching capability and the photonic switching technology under a unified GMPLS control plane would significantly enhance the forwarding capacity of the IP network, while greatly reducing number of network elements to be managed in an IP network [Sato02]. One of the other forces driving the construction of a unified GMPLS control plane is the desire to implement a multilayer routing capability, which would enable effective network resource utilization of both the IP-layer and the SDH/SONET or Photonic-layer in the next generation high capacity IP+Photonic network [Oki02].

In such a network, each LSR would contain multiple-type switching capabilities such as PSC and Time-Division-Multiplexing (or SDH/SONET XC) (TDM), PSC and Lambda switching (LSC), and LSC and Fiber switching (FSC) under the unified GMPLS control plane. These LSRs with integrated switch capabilities are required to hold and advertise resource information of not only link states and network topology, but also those of the portion of internal LSR resources to terminate hierarchical label switched paths (LSPs), since circuit switch capable units such as TDMs, LSCs, and FSCs require rigid resources. For example, an LSR with the PSC+LSC integrated switching capability can forward an optical label switched path (O-LSP) but can never terminate the O-LSP, if there is no unused adaptation capability between the PSC and the LSC.

Therefore, the concept of advertising adaptation capability to terminate LSPs, within such multilayer LSRs is essential to establishing multilayer route calculation of LSPs. This concept enables a local LSR to discriminate remote LSRs based on whether or not they have the adaptation capability to terminate O-LSPs at PSCs within the remote LSRs. This realizes multilayer routing such that the electrical label switched path (E-LSP) set-up automatically triggers new O-LSP set-up and successfully forwards IP traffic even if there is no existing O-LSP.

This draft proposes the idea of discriminating the forwarding capability and adaptation capability of each switching capability in the LSR. Then, this draft proposes to redefine the interface switching capability descriptor discussed in [GMPLS-ROUT] and [GMPLS-OSPF] as the information describing the forwarding capability of each switching capability in LSRs, and to add an interface adaptation capability descriptor disseminating the LSP termination capability within multilayer LSRs. The content of this document is as follows. First, the need for redefinition and addition of these descriptors is discussed. Second, a format is proposed for the interface adaptation capability descriptor. Third, usage examples are provided of a redefined interface switching capability descriptor and interface adaptation capability descriptor for several kinds of multilayer LSRs.

3. Interface adaptation capability descriptor

This draft proposes that the interface switching capability descriptor be re-interpreted as the forwarding capability information from

an in-bound interface to an out-bound interface of a switch capability. Also, this draft proposes an interface adaptation capability descriptor that can be interpreted as the adaptation capability information from an in-bound interface to the adaptation capability or from the adaptation capability to an out-bound interface of the switch capability. By introducing such a re-definition and new descriptor, the routing engine can swiftly search which LSRs can terminate a certain encoding type of LSP and successfully establish an LSP tunnel between two PSCs.

As an example, this section considers an E-LSP+O-LSP multiple networking layer domain comprising PSC LSRs, LSC LSRs, and PSC+LSC LSRs. In the networking domain, an E-LSP networking layer has an E-LSP switching capability such as PSC-LSRs or PSC+LSC LSRs, and the links combining these LSRs are O-LSPs. On the other hand, the O-LSP networking layer has an O-LSP switching capability such as LSC-LSRs or PSC+LSC-LSRs, and the links combining these LSRs are fiber links. Therefore, the LSRs within this multiple networking layer domain shall have both these link states, i.e., not only fiber links but also O-LSPs, to select correctly routes of E-LSPs.

The LSRs discriminates the type of these links by the interface switching capability descriptor in LSAs [LSP-HIER]. The interface switching capability at both ends of a TE-link shall be [LSC, LSC], [PSC, LSC], or [TDM, LSC] for fiber links carrying a "lambda" label. On the other hand, the interface switching capability at both ends of a TE-link shall be [PSC, PSC] for O-LSPs that carry a "shim" header label, or shall be [TDM, TDM] or [PSC, TDM] for O-LSPs carrying "TDM time slot" labels. Based on the interface switching capability descriptor, the LSRs can impose proper constraints in order to calculate the route of LSPs. For example, LSRs can understand that a remote TDM LSR with [TDM, LSC] link cannot forward O-LSPs, but can terminate O-LSPs and switch the "TDM time slot".

However, LSRs cannot properly understand the O-LSP termination capability of remote LSRs, especially if the LSRs have a hybrid switch architecture such as a PSC+TDM+LSC LSR as shown below. In the LSR, LSC may have a direct inner interface not only to TDM but also to PSC. The O-LSP can be terminated by both DXC and PSC. This kind of hybrid architecture shall be very common in Photonic networks.

```
                        _______
                 ______|       |______
                |    __|  PSC  |__    |
                |   |  |_______| /|\  |
                |  \|/  _______   |   |
                |   |__|       |__|  /|\
               \|/   __|  DXC  |__    |
                |   |  |_______| /|\  |
                |  \|/   _______  |   |
                |   |__|       |__|   |
                |______|       |______|
                       |       |
          __\     /|___|       |___|\
            /    | |___|       |___| |   Fiber #1
         ========| |___|  LSC  |___| |========
                 | |___|       |___| |
                  \|   |       |   |/
                       |       |
                       .       .
                       .       .
          __\     /|___|       |___|\
            /    | |___|       |___| |   Fiber #N
         ========| |___|       |___| |========
                 | |___|       |___| |
                  \|   |       |   |/
                       |_______|
```

The problem with the use of the interface switching capability descriptor at the PSC+TDM+LSC LSR is the shortage of LSP termination capability information. The PSC+TDM+LSC LSRs provides only switching capability information, in other words, the forwarding capability information for each switching capability. Therefore, remote LSRs cannot properly understand which switching capability O-LSPs can be terminated at the PSC+TDM+LSC LSR. In the LSR, an O-LSP can be terminated both by the PSC and TDM, but the interface switch capability descriptor cannot provide sufficient information for O-LSP termination capability in the PSC+TDM+LSC LSR.

Similar circumstances can occur, if a switching fabric that supports both PSC and L2SC functionalities is assembled with LSC with "lambda" (photonic) encoding. In the switching fabric, some interfaces terminate O-LSPs and perform L2 switching, other interfaces terminate O-LSPs and perform L3 switching.

Thus, the interface switching capability descriptor provides the information mainly for the forwarding capability. In order for remote LSRs to understand properly the termination capability of LSRs, the addition of new information to the interface switching capability descriptor is essential in achieving seamless multilayer routing in a multiple layer networking domain. This approach can achieve seamless routing such as an E-LSP set-up signaling automatically triggering new O-LSPs between the LSRs that do not have a preferred O-LSP to carry the E-LSP with the knowledge of both the fiber and O-LSP link state, even if multiple kinds of switching capabilities are assembled with LSCs by miscellaneous switching architectures.

4. Encoding of interface adaptation capability descriptor

The interface adaptation capability descriptor is sub-TLV (of type TBD) of Link TLV (with type TBD) [OSPF-TE]-[ISIS-TE]. The length is the length of the value field in octets. The reason for defining new sub-TLV for the interface adaptation capability descriptor is to achieve simple and swift look-up of LSA-DB. The routing engine can ignore this sub-TLV at a cut-through LSR, and only look-up this sub-TLV at LSRs at which LSPs are terminated.

```
Sub-TLV Type      Length     Name
          15    variable     Interface Switching Capability Descriptor
         TBD    variable     Interface Adaptation Capability Descriptor
```

The format of the value field is as shown below:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Switching Cap |Num. ADP Types |           Reserved            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Enc. Type 1  |Client S.Type 1|             G-PID 1           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Bandwidth Encoding 1                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Number of Adaptations 1                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

```
|           Number of Unreserved Adaptations 1 at priority 1    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 1 at priority 2    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 1 at priority 3    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 1 at priority 4    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 1 at priority 5    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 1 at priority 6    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 1 at priority 7    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Enc. Type 2  |Client S.Type 2|             G-PID 2           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Bandwidth Encoding 2                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Number of Adaptations 2                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 2 at priority 1    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations 1 at priority 2    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                                 ...
                                 ...
|           Number of Unreserved Adaptations n at priority 5    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations n at priority 6    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Number of Unreserved Adaptations n at priority 7    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The Switching Capability (Switching Cap): 8 bits

This field contains one of the following values:

```
1     Packet-Switch Capable-1 (PSC-1)
2     Packet-Switch Capable-2 (PSC-2)
3     Packet-Switch Capable-3 (PSC-3)
4     Packet-Switch Capable-4 (PSC-4)
51    Layer-2 Switch Capable  (L2SC)
100   Time-Division-Multiplex Capable (TDM)
150   Lambda-Switch Capable   (LSC)
200   Fiber-Switch Capable    (FSC)
```

Number of adaptation types (Number of IF Types): 8 bits

This field contains a number between 0-255, which describes number of adaptation capability types connected to the client switching capability on the master switching capability described in the Switching Cap field.

Encoding type (Enc. Type): 8 bits
This field indicates the type of LSP that can be terminated by the adaptation capability. The values are defined in [GMPLS-SIG].

Client switching capable type (Client S. Type): 8 bits
This field describes the client switching capability. This field contains one of the values described in the explanation of the Switching Cap field above.

Generalized-PID (G-PID): 16 bits
An identifier of the payload carried by an LSP that can be terminated by the adaptation capability. The values are defined in [GMPLS-SIG].

Bandwidth Encoding: 32 bits
Bandwidth encoding describes the bandwidth of an LSP that can be terminated by the adaptation capability.
The values are defined in [GMPLS-SIG].

Number of Adaptations: 32 bits
The value of this field describes number of adaptation capabilities with the above described attribute.

Number of Unreserved Adaptations: 32 bits
The value of this field describes number of unreserved adaptation capabilities with the above described attribute.

5. Example of interface adaptation capability descriptor

5.1 PSC+LSC LSR

```
                        _______
              _________|       |_________
             |   ______|  PSC  |______   |
             |  |    __|       |__    | /|\
            \|/ |   |  |_______|  |  /|\ |
             | \|/  |            /|\  |  |
             |  |  \|/  _______   |   |  |
             |  |   |__|       |__|   |  |
             |  |______|       |______|  |
             |_________|       |_________|
                       |       |
          __\     /|___|  PXC  |___|\
            /    | |___|       |___| |   Fiber #1
         ========| |___|       |___| |========
                 | |___|       |___| |
                  \|   |       |   |/
                       |_______|
```

The first example is PSC+LSC-LSR. The PSC has both STM-16 POS and STM-64 POS interfaces. The LSC itself is a transparent PXC so that the LSC can forward not only an SDH encoded O-LSP but also an Ethernet encoded O-LSP. In this case, the fiber interface of the LSR advertises the interface switching capability descriptor as follows:

```
       Interface Switching Capability Descriptor 1:
          Interface Switching Capability = PSC-1
          Encoding = SDH
          Max LSP Bandwidth[p] = 2.5 Gbps, for all p

       Interface Switching Capability Descriptor 2:
          Interface Switching Capability = PSC-1
          Encoding = SDH
          Max LSP Bandwidth[p] = 10.0 Gbps, for all p

       and

       Interface Switching Capability Descriptor 3:
          Interface Switching Capability = LSC
          Encoding = Lambda (photonic)
          Reservable Bandwidth = Determined by optical technology limits
```

The LSR also advertises the interface adaptation capability descriptor as follows:

```
       Interface Adaptation Capability Descriptor:
          Switching Capability = LSC
          Number of IF Types = 2
          Encoding 1 = SDH
          Client S. Type 1 = PSC-1
          G-PID 1 = POS - Scrambling, 16 bit CRC
          Bandwidth Encoding 1[p] = 2.5 Gbps, for all p
          Number of Adaptations 1 = 1
          Number of Unreserved Adaptations 1 = variable
          Encoding 2 = SDH
          Client S. Type 2 = PSC-1
          G-PID 2 = POS - Scrambling, 16 bit CRC
          Bandwidth Encoding 2[p] = 10.0 Gbps, for all p
          Number of Adaptations 2 = 2
          Number of Unreserved Adaptations 2 = variable
```

5.2 PSC/L2SC+LSC LSR

```
                        _______
              _________|       |_________
             |   ______| PSC/  |______   |
             |  |    __|  L2SC |__    | /|\
            \|/ |   |  |_______|  |  /|\ |
             | \|/  |            /|\  |  |
             |  |  \|/  _______   |   |  |
             |  |   |__|       |__|   |  |
             |  |______|       |______|  |
             |_________|       |_________|
                       |       |
          __\     /|___|  PXC  |___|\
            /    | |___|       |___| |   Fiber #1
         ========| |___|       |___| |========
                 | |___|       |___| |
                  \|   |       |   |/
                       |_______|
```

The second example is PSC/L2SC+LSC-LSR. The PSC/L2SC have STM-16 POS interfaces. The LSC itself is a transparent PXC so that the LSC can forward not only an SDH encoded O-LSP but

also an Ethernet encoded O-LSP. In this case, the fiber interface of the LSR advertises the interface switching capability descriptor as follows:

```
Interface Switching Capability Descriptor 1:
   Interface Switching Capability = PSC-1
   Encoding = SDH
   Max LSP Bandwidth[p] = 2.5 Gbps, for all p

Interface Switching Capability Descriptor 2:
   Interface Switching Capability = L2SC
   Encoding = SDH
   Max LSP Bandwidth[p] = 2.5 Gbps, for all p

and

Interface Switching Capability Descriptor 3:
   Interface Switching Capability = LSC
   Encoding = Lambda (photonic)
   Reservable Bandwidth = Determined by optical technology limits
```

The LSR also advertises the interface adaptation capability descriptor as follows:

```
Interface Adaptation Capability Descriptor:
   Switching Capability = LSC
   Number of IF Types = 2
   Encoding 1 = SDH
   Client S. Type 1 = PSC-1
   G-PID 1 = POS - Scrambling, 16 bit CRC
   Bandwidth Encoding 1 [p] = 2.5 Gbps, for all p
   Number of Adaptations 1 = 3
   Number of Unreserved Adaptations 1 = variable
   Encoding 2 = SDH
   Client S. Type 2 = L2SC
   G-PID 2 = POS - Scrambling, 16 bit CRC
   Bandwidth Encoding 2 [p] = 2.5 Gbps, for all p
   Number of Adaptations 2 = Shared with above one
   Number of Unreserved Adaptations 2 = none
```

5.3 DXC+LSC LSR

```
                        _______
              _________|       |_________
             |  ______|  DXC  |______   |
             |  |    __|       |__    | /|\
            \|/ |   |  |_______|  |  /|\ |
             | \|/  |           /|\  |  |
             |  |  \|/  _______   |   |  |
             |  |   |__|       |__|   |  |
             |  |______|       |______|  |
             |_________|       |_________|
                       |       |
          __\     /|___|  PXC  |___|\
            /    | |___|       |___| |   Fiber #1
         ========| |___|       |___| |========
                 | |___|       |___| |
                  \|   |       |   |/
                DWDM   |_______|
```

The second example is PSC+LSC-LSR. The STM-16 interface of this Digital Cross Connect (DXC) supports two types of SDH multiplexing hierarchy. The LSC itself is a transparent PXC with external DWDM so that the LSC can forward not only STM-16 encoded O-LSP but also an STM-64 encoded O-LSP and so on. In this case, the fiber interface of the LSR advertises the interface switching capability descriptor as follows:

```
Interface Switching Capability Descriptor:
   Interface Switching Capability = TDM
   Encoding = SDH
   Min LSP Bandwidth[p] = VC-3
   Max LSP Bandwidth[p] = STM-16, for all p

Interface Switching Capability Descriptor:
   Interface Switching Capability = TDM
   Encoding = SDH
   Min LSP Bandwidth[p] = VC-4
   Max LSP Bandwidth[p] = STM-16, for all p

and

Interface Switching Capability Descriptor:
   Interface Switching Capability = LSC
   Encoding = SDH
   Reservable Bandwidth = Determined by DWDM
```

The fiber interface of the LSR also advertises the interface

adaptation capability descriptor as follows:

```
       Interface Adaptation Capability Descriptor:
          Switching Capability = LSC
          Number of IF Types = 1
          Encoding = SDH
          Client S. Type = TDM
          G-PID = Byte Synchronous mapping of E1
          Bandwidth Encoding [p] = 2.5 Gbps, for all p
          Number of Adaptations = 3
          Number of Unreserved Adaptations = variable
```

5.4 PSC+DXC+LSC LSR

```
                    _______
             ______|       |______
            |    __|  PSC  |__    |
            |   |  |_______| /|\  |
            |  \|/  _______   |   |
            |   |__|       |__|  /|\
          \|/   __|  DXC  |__     |
            |   |  |_______| /|\  |
            |  \|/  _______   |   |
            |   |__|       |__|   |
            |______|       |______|
                   |       |
        __\     /||       ||\
          /    | ||       || |   Fiber #1
       ========| ||  OXC  || |========
               | ||       || |
                \||       ||/
             DWDM|_______|
          (SDH framed)
```

The third example is PSC+DXC+LSC-LSR. The O-LSP can be terminated by both DXC and PSC. This example assumes that DWDM and OXC are connected in such a way that each interface on the OXC handles multiple wavelengths individually. In this case, an interface at the OXC is considered to be LSC, and not FSC. A TE link is a group of one or more of the interfaces at the OXC. All lambdas associated with a particular interface are required to have identifiers unique to that interface, and these identifiers are used as labels

(see 3.2.1.1 of [GMPLS-SIG]).

The adaptation capability of LSC is directly faced with both DXC and PSC. These interfaces are STM-16 interfaces. The STM-16 interface of the DXC supports two types of SDH multiplexing hierarchy. The DXC also has the interface faced with PSC and whose interface type is the STM-16 POS interface. In this case, the fiber interface of the LSR advertises the interface switching capability descriptor as follows:

```
Interface Switching Capability Descriptor:
   Interface Switching Capability = PSC-1
   Encoding = SDH
   Max LSP Bandwidth[p] = 2.4 Gbps, for all p

Interface Switching Capability Descriptor:
   Interface Switching Capability = TDM
   Encoding = SDH
   Min LSP Bandwidth[p] = VC-3
   Max LSP Bandwidth[p] = STM-16, for all p


Interface Switching Capability Descriptor:
   Interface Switching Capability = TDM
   Encoding = SDH
   Min LSP Bandwidth[p] = VC-4
   Max LSP Bandwidth[p] = STM-16, for all p

and

Interface Switching Capability Descriptor:
   Interface Switching Capability = LSC
   Encoding = SDH
   Reservable Bandwidth = STM-16
```

The fiber interface of the LSR also advertises the interface adaptation capability descriptor as follows:

```
Interface Adaptation Capability Descriptor 1:
   Switching Capability = LSC
   Number of IF Types = 2
   Encoding 1 = SDH
   Client S. Type 1 = PSC-1
   G-PID 1 = POS - Scrambling, 16 bit CRC
   Bandwidth Encoding 1 [p] = 2.5 Gbps, for all p
   Number of Adaptations 1 = 1
```

```
      Number of Unreserved Adaptations 1 = variable
      Encoding 2 = SDH
      Client S. Type 2 = TDM
      G-PID 2 = Byte Synchronous mapping of E1
      Bandwidth Encoding 2 [p] = 2.5 Gbps, for all p
      Number of Adaptations 2 = 1
      Number of Unreserved Adaptations 2 = variable

   and

   Interface Adaptation Capability Descriptor 2:
      Switching Capability = TDM
      Number of IF Types = 1
      Encoding = SDH
      Client S. Type = PSC-1
      G-PID = POS - Scrambling, 16 bit CRC
      Bandwidth Encoding [p] = 2.5 Gbps, for all p
      Number of Adaptations = 1
      Number of Unreserved Adaptations = variable
```

As discussed in these examples, the dissemination of the interface adaptation capability descriptor helps to search correctly LSRs to terminate LSPs routed by circuit switch capabilities such as FSC, LSC, and TDM.

6. Security Considerations

Security issues are not discussed in this draft.

7. References

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